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# OCCUPATIONAL SAFETY, HEALTH, AND OCCUPATIONAL MEDICINE REPORT



NAVAL NUCLEAR PROPULSION PROGRAM  
OFFICE OF NAVAL REACTORS  
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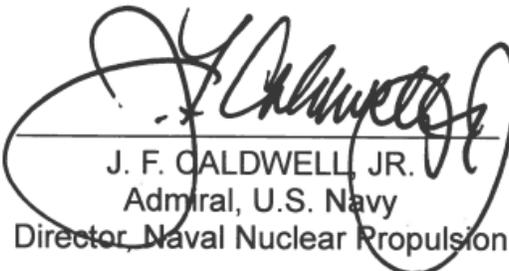
OCCUPATIONAL SAFETY, HEALTH,  
AND OCCUPATIONAL MEDICINE REPORT

2021

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This report and other reports produced by the NR Program are available online at:

<https://www.energy.gov/nnsa/articles/naval-reactors-annual-reports>

## SUMMARY

The Naval Reactors (NR) Program is responsible for the Naval Nuclear Laboratory (NNL), which consists of two Department of Energy (DOE) laboratories, one DOE facility with one prototype naval nuclear propulsion plant, and one DOE facility which operates the Expanded Core Facility, and one Department of Navy training facility with three nuclear-powered moored training ships. The NR Program is founded upon the principle of risk reduction through the identification, assessment, and mitigation of hazards when planning for site operations, developing procedures, and designing systems and facilities. The following summarizes the NR Program's performance in worker protection:

- Robust Safety Culture: The NR Program's Concept of Operations for work promotes a safe and productive work environment that enables our people to meet the challenges of a new era of great power competition by developing risk mitigation measures that are commensurate with the risks involved and establishing clear lines of responsibility and authority. People are the Program's most important asset and must be treated that way every day, and leaders must maintain a mindset that people should never get injured or exposed to an unacceptable risk of a life-changing event while they are at work. These concepts are fulfilled through the implementation of several key principles, including proactive management stance towards safety, peer-to-peer ownership of safety, and commitment to continuous improvement. Primary responsibility for employee safety and health resides with line management and the workers themselves, with assistance and oversight from industrial hygiene, safety, and medical professionals. Inspection, oversight, and feedback systems are designed to provide continuous improvement.
- Finding and Correcting Deficiencies to Prevent More Significant Problems: The NR Program focuses on identifying near-miss incidents that do not result in personnel injury and addressing underlying causes. Over the past fifteen years, there has been an overall downward trend in the number of near-miss incidents, indicating that the NR Program's vigilant efforts to identify and fix safety deficiencies are reducing the frequency and severity of safety issues.
- Healthy and Productive Workforce: The number of occupational injuries experienced continued to remain low as a result of ongoing efforts to further strengthen the safety culture. Excluding recordable cases of COVID-19, the NR Program's recordable injury and illness case rate (as defined by the Occupational Safety and Health Administration) in 2021 was 0.55 cases per 200,000 hours worked, lower than the NR Program's five-year average rate of 0.75 and more than four times lower than the U.S. general industry rate in 2020 (2.9 cases per 200,000 hours worked). Including recordable cases of COVID-19, the NR Program's recordable injury and illness case rate in 2021 was 0.95 cases per 200,000 hours worked, (see page 27 for additional discussion on recordable COVID-19 cases). The NR Program has experienced no occupationally related fatalities at its DOE facilities in over 30 years.

## NAVAL REACTORS PROGRAM MISSION AND BACKGROUND

### Vision, Mission, and Core Values

The NR Program vision is a U.S. Navy fleet that dominates the maritime domain with unmatched power and propulsion. The Program mission, in support of this vision, is to harness the atom to safely, reliably, and affordably power a global fleet that enables unrivaled responsiveness, endurance, stealth, and warfighting capability. Successful execution of the mission is dependent on adherence to the following core values:

- People, not organizations, get things done
  - We invest in our people, progressively give them more authority and responsibility, and develop them to reach their potential. We insist on a professional and respectful culture that enables all our people to perform their best.
- Technical excellence, always
  - We endlessly pursue a more thorough understanding of our work. We are failure intolerant where necessary and accept calculated risks where practical. We provide unrivaled performance for the Navy.
- Integrity in all circumstances
  - We keep our word and do what is right, even when it's painful. We respond forcefully and immediately to the demands of our obligations. We will never abdicate the responsibility of managing an unforgiving technology from cradle to grave.
- Challenge what's possible
  - We relentlessly pursue opportunities to improve our Program. We identify and overcome the boundaries that restrain us. We are never satisfied with the status quo.

### Background

The NR Program is comprised of military personnel and civilians who design, build, operate, maintain, and oversee operation of naval nuclear-powered ships and associated support facilities. The NR Program has a broad mandate, maintaining responsibility for nuclear propulsion matters from cradle to grave. NR Program responsibilities are delineated in 50 USC §2406 and §2511 setting forth Executive Order 12344 of February 1, 1982 as written (references 1 and 2), and 42 USC § 7158. These responsibilities encompass:

- The Navy's nuclear-powered warships.
- The Naval Nuclear Laboratory (NNL).
- Contractors responsible for the design, procurement, and construction of propulsion plant equipment.

- Shipyards that construct, overhaul, and service the propulsion plants of nuclear-powered vessels.
- Navy nuclear support facilities and tenders.
- Naval nuclear power schools, moored training ships, and a prototype training reactor plant.
- The Naval Nuclear Propulsion Program Headquarters and field activities.

The NR Program includes the NNL which consists of four Government-owned/contractor-operated DOE facilities (Knolls Laboratory, Bettis Laboratory, the Kenneth A. Kesselring Site, and Naval Reactors Facility) operated by Fluor Marine Propulsion, LLC. NNL has a combined staff of over 7,800 engineers, scientists, technicians, and support personnel and also provides technical assistance at one naval installation (NPTU-Charleston). Each site serves a unique role in the NR Program's mission to develop nuclear propulsion systems, train sailors to operate these systems, and provide lifecycle support from technology development through design and ultimately to disposal.

Bettis and Knolls, located in Pennsylvania and New York, respectively, are principally research and development laboratories devoted solely to naval nuclear propulsion work. These laboratories develop advanced naval nuclear propulsion technology and provide technical support for the continued safe, reliable operation of all existing naval reactors. Naval Reactors Facility, located within Idaho National Laboratory, houses the Expanded Core Facility. At the Expanded Core Facility, naval spent nuclear fuel from nuclear-powered warships and the NR Program's prototypes is examined for evidence of any unusual conditions such as unexpected corrosion, unexpected wear, or structural defects. The examinations provide data on current reactor performance, validate models used to predict performance, and support research to improve reactor design. Following examination, this facility also prepares naval spent nuclear fuel for long term storage in locations such as a geological repository.

The Kesselring Site houses one operational land-based prototype nuclear propulsion plant in New York, which provides a platform for the operational testing of promising new designs and technologies under typical operating conditions before introduction into the Fleet. The prototype facility also supports the unique training requirements of the NR Program and is staffed by highly qualified instructors. Naval Reactors Facility and the Kesselring Site have shut-down and defueled prototype nuclear propulsion plants, which are in various stages of layup, inactivation, and dismantlement. The NR Program established a Nuclear Power Training Unit (NPTU-Charleston) with moored training ships at Joint Base Charleston, South Carolina, in 1989. Three nuclear-powered submarines, which have been decommissioned and converted for training, are moored at the facility. Navy personnel operate the facility with the assistance of NNL technical staff.

These facilities provide hands-on training so that, before their first sea tour, all operators have qualified on an operating nuclear reactor. Training on operating nuclear reactors is a cornerstone of NR Program training to ensure continued safe operation of propulsion plants in nuclear powered warships.

### Scope of Report

The NR Program is solely responsible for Occupational Safety, Health, and Occupational Medicine (OSHOM) matters at its NNL facilities, which are operated exclusively for the NR Program. Within the Navy Occupational Safety and Health (NAVOSH) Program, the NR Program is responsible for OSHOM matters at NPTU-Charleston. Therefore, this report focuses on the non-radiological OSHOM programs at NNL facilities and NPTU-Charleston. Non-radiological OSHOM matters at other Navy facilities (e.g., shipyards or support facilities) are the responsibility of other Navy organizations (although the NR Program assists these organizations with OSHOM matters that could affect naval nuclear propulsion plant operations and maintenance). The NR Program is also responsible for radiological health and safety at Navy facilities and ships where naval nuclear propulsion work is performed. Radiological safety and health information for the NR Program is described in detail in two other publicly available reports (references 3 and 4). This report covers calendar year 2021. Occupational safety and health data for calendar years 2017 through 2021 are included to allow comparison of NR Program performance in recent years.

### Past Operations

Safety, Industrial Hygiene, and Occupational Medicine programs were developed and implemented in the earliest years of the NR Program in the form of documented principles, practices, procedures, and facility safety manuals. The Atomic Energy Act of 1954 assigned to the Atomic Energy Commission (AEC), the predecessor to the DOE, responsibility for regulation of activities conducted pursuant to the Act to protect safety and health. Basic requirements were promulgated by the AEC Manual, Part 0500 "Health and Safety", which established standards applicable to all AEC contractor operations. OSHOM programs were staffed with individuals dedicated to these functions.

Since passage of the Williams-Steiger Occupational Safety and Health Act of 1970 (OSH Act), the national standard of care for occupational safety and health has improved. Under the OSH Act, the NR Program retained authority for OSHOM programs of its contractors and has mandated proactive programs and practices at least as stringent as those required by the Occupational Safety and Health Administration for commercial facilities. The various contractor safety, industrial hygiene, and medical programs have been dynamic and have grown substantially since their inception.

## Militarily Unique Mission and Facilities

As previously stated, a major responsibility of the NR Program is to train naval personnel to operate naval nuclear propulsion plants. At NPTU-Charleston, this training is conducted aboard specially modified, moored nuclear-powered submarines that have been decommissioned and converted for training. At the Kesselring Site, training of naval personnel is conducted in a land-based prototype naval nuclear propulsion plant, which is representative of the engineering spaces aboard naval nuclear-powered warships. Qualified naval and contractor personnel conduct the training.

Procedures used by the NR Program to operate the nuclear reactors and associated systems in the land-based prototype propulsion plant are nearly identical to those used in warships. This includes the use of the same Navy shipboard occupational safety and health requirements as those applied in the Fleet. The Navy safety and health requirements are tailored to meet the militarily unique aspects of the "sea services" and combat roles of warships. Training naval personnel in settings and operations as similar as possible to those encountered at sea is a fundamental tenet of the NR Program that directly contributes to the safe operation of shipboard reactors.

In implementing the OSH Act, Executive Order 12196 (reference 5), and 29 Code of Federal Regulations (CFR) 1960 (reference 6) recognized the unique equipment and operations used by the military and exempted militarily unique equipment and operations from coverage by OSH Act regulations.

Heat stress, lock-out/tag-out procedures, and structural safety requirements (e.g., hand rails) are examples of areas where civilian OSHOM requirements must be reconciled with the configuration and operational requirements of militarily unique equipment. For such equipment and operations, the Department of Defense NAVOSH occupational safety and health programs (references 7 and 8) ensure that personnel are protected.

## POLICY AND IMPLEMENTATION

### Naval Reactors Program Policy

It is the policy of the NR Program to eliminate or control workplace hazards such that all employees are provided with a safe and healthful workplace and return home each day in the same, if not better, condition than the condition in which they arrived. Naval Reactors believes that to have an effective safety program, a culture must be established which values a willingness to learn from mistakes without adding unnecessary requirements, encourages reporting of and correcting unsafe practices and conditions without fear of retribution, and has in place a just process to investigate and correct underlying systemic issues.

Naval Reactors issued the above revised policy and the following guiding principles in December 2007. Adoption and application of these principles is the cornerstone of the NR Program's safety program.

- Maintain a Just Culture: Recognizing that only a small portion of errors and unsafe acts are reckless, the response to most safety-related problems must primarily focus on the systemic failures that caused the event. This just mindset results in a work environment built on a foundation of mutual trust between all levels of the organization.
- Proactive Management Stance: Steps are taken by management to identify recurrent error traps and remove them. Workplace and organizational factors likely to provoke errors are identified and eliminated. Management conducts routine surveillances to identify and correct safety program weaknesses.
- Ownership of Safety Programs: Employees demonstrate individual and peer-to-peer (i.e., work-team backup) ownership of safety for themselves and those around them.
- Culture of Learning: All organizational personnel are encouraged to acquire the mental and technical skills necessary to achieve safe and effective work performance by developing an eye and attitude that anticipates possible errors.
- Promote Self-Identification of Safety Related Problems: Measures are established that eliminate fear of management reprisal and promote development and modification of safety practices throughout the organization by each individual.
- Participation in Safety Programs: Personnel from all departments and levels are involved in developing, implementing, and reviewing safety programs, including problem analysis and resolution.
- Commitment to Continuous Improvement in Safety of the Workforce: Personnel at all levels of the organization are committed to apply the necessary resources to identify and implement improved safety practices where appropriate.
- Application of Lessons Learned: Safety-related problems and lessons learned are routinely reviewed at high-level organization meetings. Lessons learned that are systemic in nature are implemented as facility-wide reforms rather than localized to the specific event.
- Conflict Resolution: Measures are in place to address conflicts between safety programs and other organization goals in a timely, effective, and transparent manner.
- Safety Risk Mitigation: Safety, productivity, and efficiency are realized by balancing engineering, training, supervision, and oversight based on the worker's experience and proficiency along with the complexity and risk associated with the task.

## OSHOH Program Elements

Engineering methods are used first to eliminate or minimize hazards to the extent possible. Remaining hazards are controlled through detailed technical work procedures and supervisory oversight practices that are recognized as industry standards. These techniques include:

- Establishment of Responsibilities: All levels of management and supervision are assigned accountability and ownership for the safety and health of themselves, their workers, and their peers.
- Qualified Professional Staffing: The OSHOH programs at NR Program facilities include certified professionals in the disciplines of Occupational Safety, Industrial Hygiene, and Occupational Medicine.
- OSHOH Training of Management and Workers: In addition to the professional OSHOH staff, numerous other site personnel are trained and assigned collateral OSHOH duties, such as workplace safety monitors. Site management, supervisors, and workers are trained on policies and procedures, physical and chemical hazard recognition, control strategies and requirements, emergency procedures, and employee concern resolution processes. Furthermore, all employees receive behavior-based safety training to help them recognize and correct at-risk behavior patterns that could lead to mistakes and injuries.
- Planning: Site safety and health professionals review work plans and specifications to ensure that potential hazards have been identified and eliminated or mitigated.
- Identifying, Tracking, and Trending Safety Deficiencies: All employees are trained to play an active role in the identification and correction of potential hazards and minor safety deficiencies to ensure that small problems do not become large issues and that the workplace is free of recognized hazards. Tracking mechanisms are in place to monitor the status of safety deficiency corrective actions and to facilitate periodic data analysis to support early identification of performance trends.
- Emergency Preparedness: Emergency procedures are well documented. Emergency responders and supervisors must pass initial qualifications and routinely drill to maintain and improve their response skills. Trained personnel are available around the clock to respond to emergency situations and provide first-aid.
- Extension of OSHOH Program to Subcontractor Employees: Subcontractors working at NR Program facilities are required by contract to work to safety and health requirements consistent with those implemented for NR Program facility employees. Subcontractor compliance with safety and health requirements is overseen by site personnel. Information on subcontractor performance, including safety event and injury data, is incorporated into the NR Program data presented in Figures 1 through 5.

- Written Requirements: Employees work to detailed written requirements, such as manuals and procedures, which incorporate safety and health requirements.
- Routine, Independent OSHOM Assessments: Naval Reactors Headquarters and field office personnel, as well as dedicated auditors within the site's organization, independently evaluate OSHOM programs. Assessments are detailed, formal, and documented; corrective actions are tracked to closure.

## Hazard Assessments

The Naval Reactors OSHOM Program is founded upon the principle of risk reduction via the identification, assessment, and elimination/mitigation of safety or health hazards. Hazard evaluation and mitigation is a fundamental and inherent step to planning and performing any NR Program work, including facility operations and the design of facilities and systems. The degree and formality of the hazard evaluation is commensurate with the magnitude, complexity, and/or uniqueness of the task or design.

Methods of identifying and assessing hazards include:

- Baseline safety and industrial hygiene surveys.
- Routine self-inspection and self-appraisal programs.
- Hazard analysis processes, which include the assessment of potential hazards associated with certain job categories or specific tasks and identification of hazard mitigation actions.
- Industrial hygiene monitoring programs that use state-of-the-art equipment and independent laboratory analysis in accordance with modern industry standards.
- Accident investigation systems, which ensure timely review, provide written reports with thorough causal analyses, and ensure responsive corrective actions are tracked to closure.
- Independent audit and surveillance programs which verify, through formal evaluations and assessments, that worker protection standards are being met.

As hazards are identified and assessed, mitigation strategies are developed to protect employees. Hazard mitigation adheres to the fundamental principle that the most direct, effective, and feasible hazard mitigation measures, built around the following hierarchy of controls, are implemented:

1. Eliminate the hazard where feasible and appropriate.
2. Substitute less hazardous methods and/or materials where feasible and appropriate.
3. Utilize engineering controls where feasible and appropriate.
4. Apply administrative controls that limit worker exposures.
5. Use Personal Protective Equipment (PPE).

### Worker Participation

Workers participate in various committees, internal programs, and facility audits and inspections. Employees are encouraged to report their concerns to management, to safety and health professionals, or formally document their concerns via an employee concerns program (reference 9). Employee/management communications include follow up and tracking of employee concerns and of issues identified during inspections, audits, or committee meetings.

## OSHOM REQUIREMENTS

### Naval Reactors Program Authority and Responsibility for Occupational Safety and Health

Under the Atomic Energy Act of 1954, the DOE is assigned authority to set and enforce occupational safety and health standards for facilities and activities covered by the Act. Within the DOE, authority to set and enforce these standards at NR Program facilities is assigned to the Deputy Administrator for Naval Reactors, pursuant to 50 U.S.C. §2406 and 2511, which codify Presidential Executive Order 12344 of February 1, 1982 (references 1 and 2). These documents establish that the Deputy Administrator for Naval Reactors is responsible for all matters pertaining to naval nuclear propulsion. The NR Program establishes and enforces OSHOM requirements at NNL facilities, independent of other DOE organizations (e.g., nuclear fuel and weapons production operations); this ensures OSHOM standards are technically sound and consistently applied to support the militarily unique training mission (discussed earlier).

For nearly all other civilian workplaces, the Occupational Safety and Health Act of 1970 provides authority to set occupational safety and health standards. The OSH Act excludes from its scope activities that are regulated under separate statutory authority, such as the Atomic Energy Act discussed above. For Federal workplaces, each Federal agency (e.g., the Department of the Navy, the DOE) is responsible for establishing and maintaining an effective and comprehensive occupational safety and health program consistent with the OSH Act. The Navy's program and standards are documented in Chief of Naval Operations (OPNAV) Instruction 5100.23 (reference 7). Consistent with 50 U.S.C. §2406, 2511 which codify Executive Order 12344 (references 1 and 2), the NR Program enforces the implementation of these requirements, as well as the militarily unique requirements in OPNAV Instruction 5100.19 (reference 8), at NPTU Charleston and the NNL prototype facility at the Kesselring Site.

### Naval Reactors Safety Requirements Manual

In 2009, the NR Program implemented the Naval Reactors Safety Requirements Manual (SRM) (reference 9). The SRM references the OSHOM standards selected as the basis for the NR Program requirements, including Federal regulations, DOE directives, NAVOSH program requirements, and NR Program directives. Additional requirements have also been specified to ensure compliance with NR safety program standards. The goal of the SRM is to provide a streamlined approach to documenting and communicating safety requirements, written in such a way as to be easily understood by the workforce. The SRM replaces the Health and Safety Standards Reference Document (HSSRD) (reference 10), which listed safety, health, and fire protection standards selected for implementation at each NR Program facility. The HSSRD was phased out with revision 6 of the SRM in December 2019.

## Implementation of DOE Directives and Navy Occupational Safety and Health Program Requirements

The NR Program uses DOE directives to aid in setting the standards for its NNL facilities. Since DOE directives are focused on non-military activities, some of the requirements may not be directly applicable to NR Program activities. Such requirements are modified by the NR Program as necessary to integrate the DOE requirements with NAVOSH requirements and militarily unique systems and operations, intended to prevent conflicts with Navy training requirements and to maintain the prototypes' ship-like environment.

NAVOSH requirements are applied (references 7 and 8) as specified by the SRM (reference 9) because the moored training ships are part of a Department of Defense facility.

## Occupational Medicine Program Requirements

The NR Program occupational medicine requirements for contractors at NNL facilities and NPTU-Charleston are consistent with the DOE's occupational medicine requirements (reference 11) and have been included in the SRM (reference 9). Navy occupational medicine requirements (reference 12) are applicable to naval personnel at DOE facilities and NPTU-Charleston.

## PERSONNEL

### Naval Reactors Contractor Health and Safety Council

The NR Program maintains the NR Contractor Health and Safety Council, whose membership includes senior safety and health professionals from each NR Program facility. The purposes of the Council are: (1) to provide a forum in which experiences and information can be exchanged and new safety and health initiatives can be identified and quickly implemented; and (2) to maintain the NR Program and Corporate manuals (e.g., SRM). The Council accomplishes these functions during conferences held at least monthly. Additionally, Health and Safety directors from each facility meet annually with NR Program Headquarters personnel to review performance and establish performance objectives for the coming year.

### Professional Staffing

Professional staffing is assigned to OSHOM programs to ensure a safe and healthful workplace at all NR Program facilities. All key occupational safety and health professionals satisfy, at a minimum, the requirements contained in the United States Office of Personnel Management standards for Safety and Occupational Health Manager, Safety Engineer, or Industrial Hygienist (reference 13). Each NR Program Site is staffed by, or has contractual arrangements with, one or more physicians who are board-certified or experienced in occupational medicine.

The NR Program's safety and health professionals are qualified by their academic backgrounds and/or experience to perform workplace evaluations, technical monitoring, testing, consulting, and other essential functions of their professions. Involvement with professional organizations is supported and facility staff hold memberships in a variety of major safety and industrial hygiene professional societies.

Many safety and health professionals hold certifications from the American Board of Industrial Hygiene and/or the Board of Certified Safety Professionals. These professionals must pass rigorous examinations to certify that they are specially trained, knowledgeable, and competent in industrial hygiene and/or safety.

The capabilities of all safety and health professionals are enhanced by attendance at professional technical society meetings, participation in continuing education programs at universities and other recognized training centers, and involvement with internal education and training programs developed by individual NR Program facilities. These activities are designed to improve the safety and health professionals' ability to recognize potential workplace hazards; measure, analyze, and evaluate occupational safety and health trends; and define and implement effective controls.

OSHOM managers are experienced individuals with extensive education and rigorous training that qualify them to manage these programs. Although these managers report to the facility manager (Commanding Officer at NPTU-Charleston), their oversight role remains independent from production concerns.

The safety and health professionals at NR Program facilities monitor the workplace, evaluate workplace hazards, implement appropriate controls, review work procedures for proper safety controls, analyze safety and health performance indicators, and maintain appropriate records. In general, however, the safety and health professionals are not directly involved in facility operations unless specific safety issues arise. In such cases, they work with the facility operations staff and Navy personnel to resolve the issue.

### Operations Personnel

The NR Program promotes ownership of safety by the workers at all levels of the organization. Operations personnel are provided general and job-specific safety training to enable them to identify safety hazards and unsafe work practices and take action to enable the prompt resolution of the deficiency.

First-level operations supervisors, such as work-area managers, are given primary responsibility for the safety and health of their subordinates. With the assistance of NR Program safety professionals, these personnel are responsible for the identification and development of NR Program specific safety requirements and best practices to ensure the safe and efficient conduct of NR Program operations and maintenance.

Upper-level operations managers at NR Program facilities are also responsible for the safety and health of personnel. They reinforce the importance of safety and health requirements by establishing applicable policies and objectives and assigning appropriate responsibility and authority to all levels of management and supervision.

### Naval Reactors Field Representatives

All NR Program facilities have a co-located Naval Reactors field office. The field office is staffed with Naval Reactors personnel who report directly to Headquarters and whose function is to ensure contractor compliance with NR Program requirements. The field office representatives provide independent oversight of facility operations, thereby allowing Naval Reactors Headquarters to maintain close surveillance of events occurring at the facilities. Each field office has personnel with specific responsibilities in OSHOM matters to effectively oversee facility OSHOM programs.

### Navy Personnel Assigned to Naval Reactors Program Facilities

Active-duty Navy personnel are assigned to the Naval Reactors NNL prototype facility and NPTU-Charleston to conduct and receive training in the operation of naval nuclear propulsion plants. The safety and health of these personnel is the overall responsibility of the Commanding Officer, Nuclear Power Training Unit (located on site). The prototype plant and the moored training ships have safety representatives who are responsible for ensuring that safety and health requirements are implemented and followed. The safety representatives have access to, and work with, the safety and health professionals at the facility to resolve any OSHOM issues. The Commanding Officer also maintains a liaison with a nearby Naval Branch Medical Clinic, which provides occupational medicine support services to Navy personnel. The facility OSHOM personnel work with the affiliated Naval Branch Medical Clinic to ensure the safety and health of Navy personnel.

### Emergency Response Capability

Each NR Program site has emergency response capabilities for significant events. At each site, qualified individuals are assigned to respond to the scene of any emergency that may occur, evaluate the circumstances, and initiate appropriate corrective actions. When necessary, a separate emergency control center is manned with personnel trained to handle a variety of emergencies. Individuals are assigned to emergency response teams on the basis of their expertise and experience. Emergency responders frequently train and drill to improve their skills and maintain their qualifications. Major drills involving the entire emergency response team are conducted periodically; smaller drills involving limited participation are conducted more frequently.

Each operating site has personnel qualified to provide emergency medical care. Most sites are also staffed with one or more medical doctors. Additional groups of individuals (e.g., Emergency Medical Technicians) are specifically trained and assigned to provide medical assistance. Each site has arrangements with a local hospital to provide emergency medical care beyond the capabilities of site medical personnel and conducts a drill with emergency responders at least once a year.

## HAZARD IDENTIFICATION AND ANALYSIS

### Regulations, Requirements, and Technical Information

To maintain a current level of knowledge and expertise in this area, occupational safety and health professionals:

- Review the Federal Register (reference 14) and subscribe to review services to identify new or proposed regulations and determine their applicability to NR Program facilities. The results of these reviews are provided to the other safety and health professionals and operations personnel.
- Review and incorporate applicable safety and health requirements and lessons learned into facility procedures. Such requirements and lessons learned are found in DOE and Navy safety and health bulletins and other relevant documents.
- Maintain professional certification in the fields of safety, industrial hygiene, or occupational health.
- Participate in professional societies (e.g., the American Industrial Hygiene Association, American Society of Safety Engineers, American College of Occupational and Environmental Health, and the American Association of Occupational Health Nurses) that provide information via publication of professional journals, national conferences, seminars, and society meetings.
- Discuss and resolve safety and health issues in the NR Contractor Health and Safety Council conferences.

### Project Evaluation

Site projects involving work that could affect the safety and health of personnel are reviewed and evaluated by the activity and the respective facility safety and health professionals. These evaluations typically involve review of the work project from initial concept through the development of detailed work procedures or construction plans and technical specifications. One of the primary functions of this conceptual review is to identify alternate methods or materials that can eliminate or reduce the hazards associated with the project under review. Project managers, with the assistance of safety and health professionals, ensure that applicable safety and health practices are integrated into written work procedures and that all applicable fire and life safety code requirements are satisfied.

The qualifications and work practices of subcontractors to perform specific facility project work are evaluated by project managers and safety and health professionals to ensure that subcontractor work meets NR Program standards. The safety and health standards that subcontractors must use are incorporated directly into the contractual requirements set forth in requests for proposals and purchase orders.

## High Risk Work

High risk work is defined by the NR Program as any evolution that, if performed improperly, may present a significant risk of injury or fatality (e.g., certain types of electrical work, work requiring personal fall protection). The SRM (reference 9) includes requirements for high risk work which are the product of a comprehensive review, performed in February 2007, by representatives of each NR Program facility of safety practices used during industrial work. Specifically, the SRM defines the types of high risk work and provides requirements for engineering, planning, controlling, and overseeing the conduct of that work.

The high risk work requirements apply during all phases of the proposed high risk work: the up-front engineering and planning of the work, the preparation of the worker who will perform the work, and the actual execution and oversight of the work. During the engineering and planning phase, the requirements state that hazards should be eliminated if feasible and appropriate. When eliminating the hazard is not practical and management decides the high risk work is necessary, hazard control mechanisms are engineered commensurate with the risk posed by the work. For example, additional safety controls, specialized worker training, and additional oversight may be included in the work plan. The line organization conducting the work determines the most feasible and appropriate solution for hazard control in accordance with the concept of operations and is overseen by safety professionals. Formal, written instructions are required for the conduct of all high risk work. Supervisor and worker formal acknowledgement along with authorization from select senior management is required to conduct high risk work. All employees performing high risk work are expected to understand the need for the high risk work, the safety requirements implemented to protect them, and the written instructions they will follow. After being briefed, the workers sign the high risk work plan indicating that the plan provides an effective hazard mitigation strategy to safely perform the work. Any employee has the authority to stop work to resolve any concern regarding the continued safe performance of the work. The process provides assurance that high risk work is conducted reliably and that all individuals involved with the work are in agreement that the selected method is the safest way to perform the work.

## Procurement Reviews

Each NR Program facility has a formal system to evaluate purchase requests for equipment and chemicals to minimize or eliminate safety and health hazards. This system includes approval of purchase requests by operations management with concurrence by safety and health professionals. Safety data sheets (SDS) for all products or materials proposed for use are reviewed by the facility's operations personnel and safety and health professionals before their initial use. This system allows identification of potential hazards and implementation of the proper protective measures to reduce these hazards.

## Hazard Analyses

Hazard analyses, such as job hazard analyses, are processes used by the NR Program to review work practices, identify safety hazards and risks associated with the work, and formally identify risk mitigation actions to protect employees.

Once potential hazards of a job or work task are identified, actions are taken to minimize the hazard and communicate appropriate precautions. Cognizant supervisors are responsible for ensuring that hazards are addressed and that corresponding tasks, equipment, or material changes are implemented. Safety and health professionals may help supervisors prepare hazard analyses and review them for accuracy and completeness.

Hazard analyses are used in training individual employees, preparing for planned safety observations, reviewing job procedures, and evaluating jobs for improvements in safety and health methods. Whenever a significant safety or health issue arises, further analyses are conducted and procedures may be altered to incorporate the lessons learned.

## Industrial Hygiene and Medical Workplace Hazard Evaluations

The basic elements of industrial hygiene and occupational medicine workplace hazard evaluations at NR Program facilities include:

- Use of appropriate exposure limits established by the Navy Occupational Safety and Health (NAVOSH) Program, Occupational Safety and Health Administration (OSHA), and American Conference of Governmental Industrial Hygienists (ACGIH) (references 7, 8, 15, 16, and 17).
- Regular worksite assessments by industrial hygiene and medical staff to evaluate potential health hazards.
- Documented review of materials, processes, work practices, and procedures used on specific jobs to determine hazard exposure potentials. These reviews determine specific job tasks that warrant routine or non-routine exposure monitoring, the use of personal protective equipment, or development of standardized work procedures to characterize and mitigate hazard exposure.
- Establishment of workplace exposure monitoring programs that characterize potential hazard exposures during normal job activities throughout the facilities. Exposures are determined using standard exposure monitoring protocols as defined by the National Institute for Occupational Safety and Health (reference 18) and other recognized formats.
- Pertinent information is forwarded to the occupational medicine department for use in evaluating the workplace environment and/or hazards applicable to each employee.

- Submission of validated exposure data to the occupational medical staff for evaluation and incorporation into NNL facility personnel medical records. For Navy personnel, relevant exposure data are sent to the Naval Branch Medical Clinic for inclusion in personnel medical records.
- Feedback to supervisory and management personnel on the results of employee exposure evaluations and monitoring so that procedural changes can be made if required.
- Medical examinations of personnel, based on potential exposures determined by the processes noted above.

### Trend Analysis

Event reports, injury/illness documentation, medical clinic records, safety deficiency reports, and other records are reviewed frequently to ensure problem areas are identified and corrective actions are appropriate. At NNL facilities, injury and illness data for civilian personnel and subcontractors are compiled quarterly and submitted to the DOE. Accident reports for naval personnel at NNL facilities and NPTU-Charleston are submitted to the Navy in accordance with NAVOSH requirements (reference 20).

Analyzing trends is one of the most effective ways to identify problem areas and institute appropriate corrective measures to reduce accidents. Evaluations of each reportable occurrence are factored into continual trend analysis by process/operation, type of injury/illness, type and frequency of safety deficiencies, or any other categorization needed to focus improvement actions at the root causes. In addition, workers' compensation records and medical clinic records provide supplemental accident history which may be used in reviewing injuries and illnesses. Following review, corrective actions (e.g., procedure revision, evaluation of work practices, additional training, hazard analysis updating) are taken. NR Program facilities analyze safety events and documented safety deficiencies, including those that do not involve injuries or illnesses, so that improvements may be implemented to prevent serious injuries. Key statistics, used as indicators to measure the effectiveness of OSHOM programs and trend analysis, are located in the "Measures of Performance" section of this report.

## HAZARD CONTROL

### OSHOH Manuals

All NR Program facilities follow requirements defined in safety, industrial hygiene, and occupational medicine manuals. Operations personnel prepare detailed written operating procedures and maintenance/repair instructions that incorporate safety and health requirements from these OSOHO manuals.

In concert with the initiative to develop the Naval Reactors Safety Requirements Manual (reference 9) previously mentioned, the NR Program has developed a Corporate Safety Manual (CSM). The CSM captures best practices and standardized work practices and processes to implement the SRM-prescribed safety requirements program-wide. The vision is to develop and implement a standardized safety program for all work performed at NR Program facilities to ensure a high degree of worker safety and compliance with all applicable NR Program safety standards and enable seamless sharing of safety-related resources between NR Program facilities. As chapters are added, the CSM will replace portions of facility-specific safety manuals and procedures.

In 2009, NR Program facilities implemented the SRM (reference 9) and associated CSM chapters developed during the initiative described above. Development work continues to incorporate all safety areas from the SRM into the CSM.

### New Employee Indoctrination

NR Program facilities indoctrinate all new employees in occupational safety and health matters. This training includes facility safety instructions, procedures for reporting injuries and concerns, employee responsibilities, personal protective equipment, introduction to the facility's OSOHO program, Hierarchy of Controls, and an overview of various facility emergency procedures.

### Hazard Communication and Awareness Training

Hazard communication programs train workers to recognize workplace hazards through chemical labeling, safety data sheets, and discussions of hazards associated with certain job tasks or work areas where chemicals are used or stored. Hazard communication programs also train workers in the appropriate protective measures needed to minimize exposure to identified chemical hazards.

In addition to hazard communication programs, general hazard awareness training is conducted to sensitize workers to look for and correct unsafe conditions or work practices that could result in injury. General hazard awareness training emphasizes and reinforces the concept that thoughtful action and attention to detail will significantly reduce the chance of personal injury.

## Continuing Training Programs

Training on OSHOM programs, as well as on many other aspects of each employee's job assignment, is regularly conducted at NR Program facilities. Continuing training provides updates on new requirements, emphasizes lessons learned from NR Program events, and ensures necessary skills and qualifications are maintained.

## Navy Student and Instructor Training

Navy students and their instructors make up a large portion of the NR Program population at the New York prototype facility and the majority of the population at NPTU-Charleston in South Carolina. The rigorous training and qualification program for all naval nuclear propulsion plant operators includes key shipboard occupational safety and health requirements such as electrical safety, chemical use, emergency response actions, protective equipment, hazardous energy control, and other related safety requirements.

## Informational Bulletins

Informational bulletins (e.g., DOE and Navy newsletters, training course schedules, defective materials notifications, and other sources of OSHOM news) are distributed to NR Contractor Health and Safety Council members and the Naval Reactors field offices. These bulletins help Council members stay up to date with the latest OSHOM developments and pass this information on to facility personnel. Each facility subscribes to a number of OSHOM publications.

## Safety Programs

Operating facilities use programs that provide peer-to-peer accountability and promote workplace observations. The observations serve to identify any hazards or unsafe work practices, but also provide reinforcement of positive safety actions and behaviors. The findings are assessed by the Site Safety Council, safety and health professionals, and operations management to determine if action is needed to enhance both individual and industrial safety.

## Concern Reporting

The NR Program has an employee concerns program in place (reference 9). The employee concerns program enables employees to raise safety and health concerns to the attention of management or safety and health professionals for corrective actions. Under these programs, employees may choose to report concerns anonymously. If the employee chooses not to report anonymously, the employee is informed of the status of corrective actions associated with the concern.

If an employee is not satisfied with the problem resolution, the concern will proceed to the next higher level of management. If the employee is not satisfied with the resolution proposed by the facility management, a procedure is in place to file concerns directly with Naval Reactors field office representatives. Employees may also bypass the management chain and file concerns directly with the Naval Reactors field office.

### Tracking and Follow-up Systems

All NR Program facilities have a systematic process for ensuring the prompt resolution of safety and health issues. Safety and health hazards are corrected immediately, if possible, or stabilized to minimize associated hazards and then formally documented for tracking until final resolution. To ensure that all issues are resolved promptly, open issues are prioritized by hazard severity, and appropriate personnel are assigned to complete corrective actions by a given date.

### Subcontractor Performance at Program Facilities

Each NR Program facility has procedures established for subcontractor work, including bidding, specification, and oversight requirements. Subcontractors augment the in-house work force for construction projects and maintenance work exceeding in-house capacity. Subcontractors performing work at NR Program facilities are required by contract to comply with safety and health standards consistent with the standards normally invoked at those facilities.

A multi-year subcontract is in place with Huntington Ingalls Industries – Newport News Shipbuilding to complete prototype refueling and overhaul work at the Kesselring Site in New York. Norfolk Naval Shipyard and Portsmouth Naval Shipyard periodically support these efforts. These organizations have extensive experience in the construction and servicing of naval nuclear-powered vessels. In addition to the oversight provided by the prime contractor responsible for facility operations, these organizations employ full-time, onsite safety and health professionals who implement OSHOM programs for their work the same as or analogous to those instituted by the prime contractor.

The Spent Fuel Handling Recapitalization Project (SFHP) is constructing the Naval Spent Fuel Handling (NSFH) Facility at the Naval Reactors Facility in Idaho. The SFHP has established its own construction management plan with requirements consistent with the DOE standards normally applied to large construction projects due to the size, complexity, and unique aspects of NSFH Facility construction. Specifically, SFHP is leveraging the expertise of an Engineering, Procurement, Construction Management (EPCM) subcontractor by applying 10 CFR 851 (subparts B & C) for construction of the NSFH Facility versus the Naval Reactors Safety Requirements Manual (reference 9).

## Subcontractor Worksite Overview

All subcontractors at NR Program facilities are responsible for the safety and health of their employees and their subcontractors, and for taking corrective action on safety and health deficiencies resulting from their operations. Subcontractors performing work at NR Program facilities are responsible for indoctrinating their personnel on all safety and health requirements, and on any job-specific requirements. The facility safety and health professionals may assist in these indoctrinations. For major subcontractors, full-time health, safety, and/or medical professionals may be required, and regular formal meetings between the subcontractor and various facility organizations are held.

For each subcontract, there is a qualified facility employee who is responsible for day-to-day oversight and coordination of subcontractor operations. In addition to tracking the progress of the work, this individual checks the adequacy of the subcontractor's safety and health programs. Each facility's safety and health professionals also monitor the subcontractor's compliance by conducting inspections and assessments of work areas. Corrective actions are formally communicated to the subcontractor and tracked in the same way as other such actions at the facility.

## HEALTH EVALUATION, DIAGNOSIS, AND TREATMENT

The occupational medicine programs at NR Program facilities are integrated into operations to ensure adequate assessment of factors that affect personnel health and wellbeing. Occupational medicine program elements are documented in the Naval Reactors Safety Requirements Manual (reference 9) and include routine employee health examinations, as well as diagnosis and treatment of occupationally-related injury or illness.

### Employee Health Examinations

Regular, routine health examinations are given to site employees to:

- Determine whether the employee's physical and mental health are compatible with the safe and reliable performance of assigned job tasks, including compliance with the Americans with Disabilities Act of 1990.
- Detect evidence of illness/injury and determine if there appears to be an occupational relationship.
- Contribute to employee health through prevention or early detection and treatment of occupationally-related injury or illness.
- Provide an opportunity for intervention by assessing risk factors which cause premature morbidity or mortality (e.g., hypertension, smoking, elevated lipids).
- Maintain documented records of the physical and mental health experience of employees.

Comprehensive health examinations are conducted by a licensed physician or by an Occupational Health Examiner under the direction of a licensed physician in accordance with accepted medical practices. Routine health examinations are required (references 9 and 11) and occur throughout an employee's career under the following circumstances:

- Pre-placement Evaluation — Medical evaluations of job applicants are conducted before initial performance of job duties and, in the case of current employees, before a job transfer. The health and fitness for duty of individuals are determined to ensure that assigned duties can be performed safely and reliably. Evaluations include review of applicable hazard analyses pertaining to the applicant/employee.
- Medical Surveillance Examinations and Health Monitoring — Special health examinations and health monitoring are conducted for employees who work in jobs involving specific physical, chemical, or biological hazards.
- Qualification Examinations — Examinations are conducted to qualify employees for job assignments for which specific medical qualification standards exist (e.g., special vehicle drivers, protective force personnel, respirator wearers).
- Voluntary Periodic Examinations — Voluntary periodic examinations are offered to employees. The frequency and type of examination offered is determined by the individual's age and work exposures.
- Return to Work from Occupational Injury or Illness — All employees with occupationally related injuries or illnesses are evaluated before they may return to work. The scope of this evaluation is determined by the Occupational Health Examiner based on the nature and extent of the injury or illness and is designed to ensure that the employee may return to work without undue health risk to himself or herself, or to others.
- Return to Work from Non-occupational Injury or Illness — Employees with significant non-occupationally related injuries or illnesses are evaluated before returning to work. The scope of the evaluation is dependent upon the nature of the injury or illness, and is undertaken to ensure that the employee may return to work without undue risk to himself or herself, or to others.
- Termination Health Evaluations — For employees leaving the NR Program, a health examination is made available to those who have known occupational illnesses or injuries; to those with documented or presumed exposures requiring evaluation by OSHA regulations (references 15 and 16); or to those who have not been examined for more than a year. Additionally, a health status review is made available for all terminating employees.

### Diagnosis and Treatment of Injury or Illness

Occupational injuries or illnesses are evaluated by medical personnel. Diagnosis and treatment of occupational injury or illness is prompt, emphasizing rehabilitation and return to work at the earliest time compatible with employee health and job safety.

A close liaison exists between the medical and safety/health communities to ensure that the causes of occupational injury or illness are fully evaluated and promptly acted upon.

### Medical Services for Navy Personnel

Medical evaluation and care for Navy personnel at NNL facilities and NPTU-Charleston are the responsibility of the local Naval Branch Medical Clinic. Immediate and emergency medical treatment for injuries or illnesses at NNL facilities is provided by the facility medical staff, with immediate follow-up consultation with Navy medical personnel. If further diagnosis or treatment is warranted, the patient will be transported to a nearby military or civilian medical facility. Follow-up medical treatment or evaluation is provided by naval medical services.

Communication between NNL prototype facility personnel and naval medical staff is coordinated through the Commanding Officer, Nuclear Power Training Unit, located at that facility. Navy medical staff visits the NNL facilities periodically and communicates directly with facility medical staff as appropriate to assist in the treatment of naval personnel.

## ACCOUNTABILITY

### Independent Overview and Investigation

Naval Reactors field offices conduct frequent inspections and audits of OSHOM programs to ascertain compliance with applicable requirements, to determine strengths and weaknesses, and to identify areas for improvement. These audits are complemented and augmented by periodic Environmental, Safety, and Health Inspections and annual program reviews conducted by Naval Reactors Headquarters personnel and representatives from other Naval Reactors field offices.

If significant safety or health events concerning civilian or Navy personnel at NR Program facilities occur, a formal independent Investigation Board is convened that includes senior personnel knowledgeable in the topical area and Naval Reactors field office or Headquarters personnel (references 7, 8, 19 and 20). The investigation typically involves extensive fact-finding, detailed review of processes and procedures, and a comprehensive evaluation of the event and its causes. The Investigation Board's conclusions are provided to the facility for review and development of corrective actions as required.

### Internal Overview and Critical Self-Assessment

Safety and health professionals at each NR Program facility perform frequent and detailed inspections and surveillances to determine how well the facility's operating personnel are implementing OSHOM programs. In addition, each facility has an auditing organization which maintains and executes an independent OSH audit and surveillance program. The program concentrates on assessing work oversight and performance of work activities, effectiveness of training, and the results of safety process implementation. Furthermore, the NR Program facilities critically self-assess their own performance to identify areas for improvement.

At each facility, senior leadership has established the expectation and has developed the behaviors within all levels of management to routinely and critically assess and improve performance within their cognizant area. The objectives of critical self-assessment are for leaders to maintain a comprehensive day-to-day understanding of the problems faced by the organization, to implement effective corrective actions, and to improve processes to prevent future problems. Effective self-assessment leads to a learning organization that demonstrates continuous improvement while efficiently producing quality results.

Critical self-assessment includes detailed reviews of functional areas where multiple organizations interact (e.g., electrical safety, elevated work) and is guided by a standardized process (reference 21). Based upon the scope and severity of the problems identified, causal analysis may be conducted by the cognizant managers and senior leadership to identify the underlying causes of potential systemic problems that may be affecting other facility operations. After the underlying causes are determined, short and long-term corrective actions are taken as necessary and the results of these actions are monitored to ensure the desired improvements are achieved.

## MEASURES OF PERFORMANCE

### Leading Indicator Metrics

Since 2007, the NR Program has used metrics from NR Program-defined Level 1 near-miss safety incidents that did not result in OSHA recordable injuries (reference 22) but had the potential to cause serious injury. Table 1 explains the primary types of Level 1 near-miss safety incidents that are used in the NR Program as leading indicator metrics. The final category, “Unsafe Behaviors or Conditions,” applies to similarly serious events that do not meet the criteria of the other categories (e.g., employee exposure to a hazardous chemical in excess of an established exposure limit, improper confined space work, improper excavation work). These near-miss metrics are used to proactively identify and evaluate events to prevent more serious accidents.

Table 1

<b>Category</b>	<b>NR Program Level 1 Safety Incident Criteria</b>
<i>Electrical Shock</i>	An electrical shock during work that requires energized electrical work controls (i.e., greater than 50 volts) or caused by defective equipment.
<i>Energized Electrical Work Control</i>	Unauthorized entry into an energized electrical enclosure where the restricted approach boundary or arc flash boundary was crossed.
	Work performed on an energized electrical system/component without applying required energized electrical work hazard controls.
<i>Improper Hazardous Energy Control</i>	Work performed on a system/equipment without the use of hazardous energy controls when such controls would be required to preclude exposure to hazardous energy
<i>Fall Protection and Elevated Work</i>	Any fall greater than 6 feet
	Work performed without the use of required fall protection when such protection would be required to preclude exposure to a fall hazard
<i>Unsafe Behaviors or Conditions</i>	Any other event, condition, or employee behavior that is judged to be of comparable risk to workers as those specified above

To standardize the measure of performance, the Level 1 safety incident criteria in Table 1 are defined in the SRM (reference 9) and are consistently applied at NNL and NPTU-Charleston. Figure 1 provides an overview of the types and numbers of safety incidents experienced across the NR Program over the past five years. The lessons learned from these events will continue to be used to improve the NR Program safety culture.

In 2021, approximately half of the Level 1 safety incidents involved electrical safety, energized electrical work controls, or improper hazardous energy control. Of these incidents, approximately half can be attributed to lack of procedural compliance or hazard recognition by Navy personnel. The increase in Navy safety incidents is primarily driven by inadequate training for sailors and supervisors on safety duties and responsibilities at NPTU – Charleston. The NR Program refocused safety training towards the day-to-day duties of Navy personnel at NPTU-Charleston to ensure they have the proper level of knowledge. Within the unsafe behaviors or conditions category, the majority of issues related to work in permit-required confined spaces or excavations performed by subcontractors. Corrective actions focused on increasing supervisor and worker level of knowledge, improving work ownership, and level of formality in work execution. All lessons learned from safety incidents are shared between program sites to increase personnel awareness and knowledge.

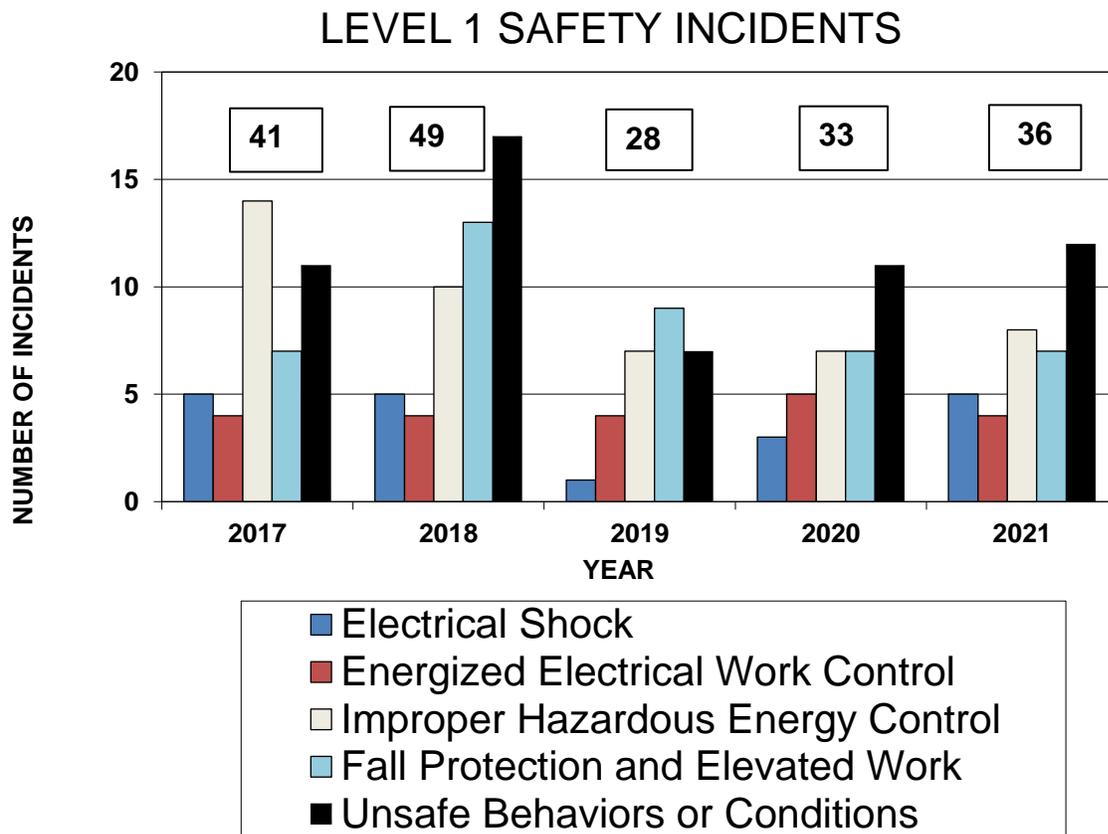


Figure 1

The NR Program also tracks numerous performance indicators to measure OSHOM program effectiveness. The indicators are consistent with those employed by general industry and the DOE using OSHA's occupational injury and illness reporting criteria (reference 22). The injury data provided for general industry were obtained from the Bureau of Labor Statistics (BLS) (reference 23). BLS data for 2021 are not currently available. The DOE data in Figures 2 through 4 in this report are taken from injury and illness data as presented by the DOE (reference 24) and include COVID-19 recordable cases for 2021. These statistics provide a standard measure of the NR Program's trends relative to the DOE and general industry.

### Fatalities

The NR Program has experienced no occupationally related fatalities at its NNL facilities or NPTU-Charleston since 1986. The NR Program has experienced three fatalities (all of which were subcontractor personnel) since the passage of the OSH Act in 1970. Two of the fatalities were due to falls; the third was an onsite suicide.

### Recordable Injury and Illness Incidence Rate

OSHA recording criteria specify the recording of all cases involving work-related injuries or illnesses that need treatment beyond first aid. However, this data does not indicate the severity of an injury or illness; it only indicates that an injury or illness has occurred. For example, a cut requiring sutures, a broken arm, and a disabling back injury are not distinguishable in the reporting system; each of these injuries would be counted as one injury in the reported data. Rather, the severity of recordable injury or illness is indicated by restriction on the individual's work activity and/or days away from work.

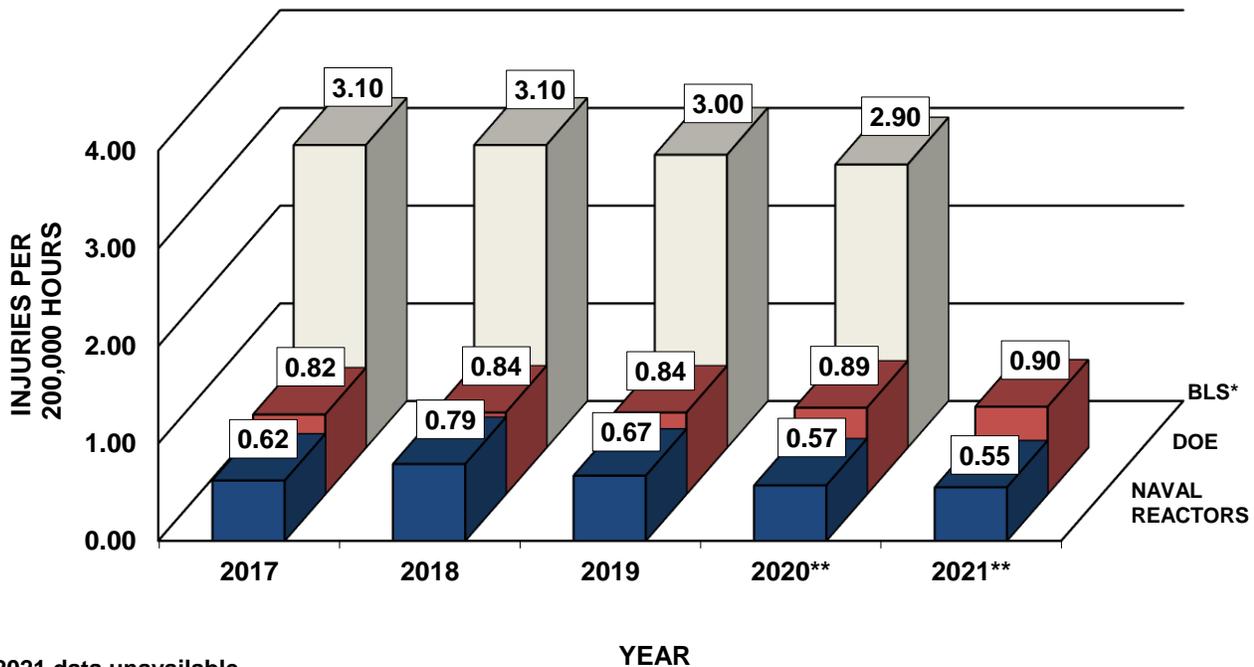
### COVID-19

The injury and illness data contained in Figure 2 through Figure 5 includes the total number of recordable injuries and illnesses both with and without COVID-19 cases. The effects of the COVID pandemic were significantly mitigated due to the proactive measures taken to protect employees and subcontractors. Apart from one outbreak of 14 COVID-19 cases in January of 2021 that was the result of poor behavior, the Program only had 10 additional COVID-19 cases in 2021 with approximately 75% of the workforce on-site.

The reporting requirements of reference (26) apply to work-related cases of COVID-19 if the following criteria are met: the cases are "confirmed" cases of COVID-19 per Centers for Disease Control and Prevention criteria; the cases are work-related as defined in reference (22) and associated OSHA guidance specific to COVID-19; and the cases involve one or more of the general recording criteria set forth in reference (22). In accordance with reference (22), a COVID-19 case may not be considered recordable if the illness was not medically diagnosed as a significant illness (e.g., an employee had mild symptoms and could work from home (telework)). Regardless of the significance of the COVID-19 case, the NR Program recorded each confirmed case of COVID-19 if it was determined to be work-related.

Figure 2 shows the total recordable injury and illness incidence rates for the civilian work force in the NR Program, DOE (reference 24), and general industry (BLS) (reference 23), to include recordable COVID-19 cases for the NR Program and DOE. The NR Program's recordable injury and illness rates average 12% lower than the comparable DOE rates and 69% lower than the BLS general industry rates over the past five years.

## RECORDABLE INJURY AND ILLNESS INCIDENCE RATE



\* 2021 data unavailable

\*\* Rates with COVID-19: 2020 - 0.73; 2021 - 0.95

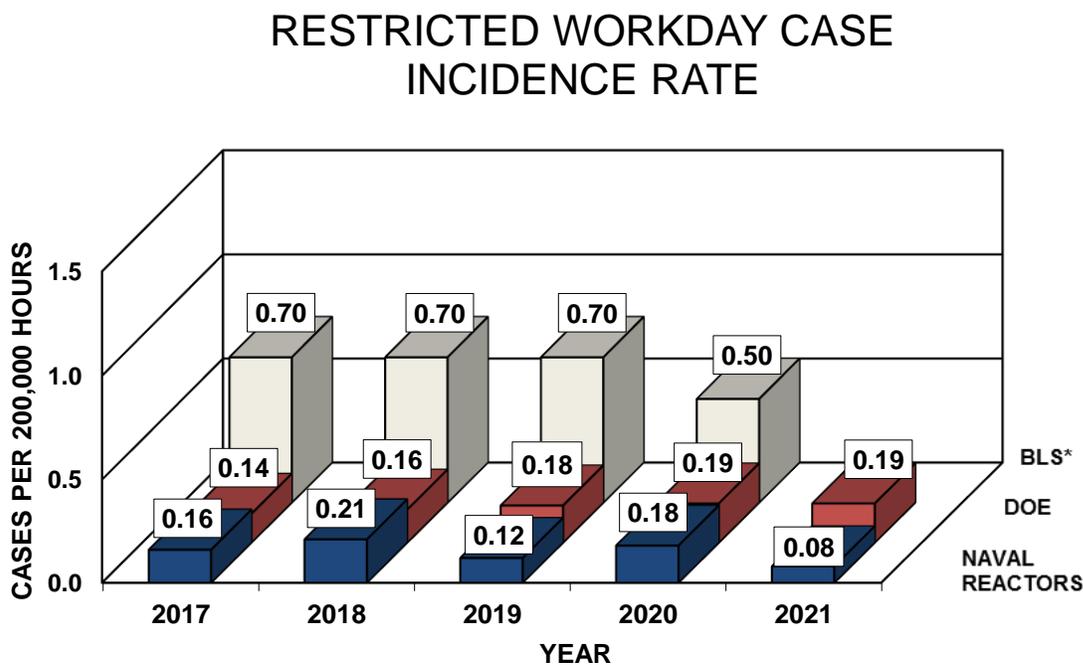
Figure 2

<sup>1</sup>Naval Reactors Program civilian workforce data in Figures 1 through 5 consist of data for civilian prime contractor and subcontractor personnel.

## Restricted Workday Case Incidence Rate

NR Program injuries and illnesses are generally minor (e.g., cuts and abrasions) and require little or no time lost from work. Figure 3 shows the NR Program, DOE (reference 24), and general industry (BLS) rates (reference 23) of occupational injury or illness cases that resulted in the individual being able to remain at work but under restricted work activity. Figure 3 shows that the NR Program's restricted workday case incidence rates have been an average of 71% lower than the BLS general industry rates over the past five years and 13% lower than the DOE 5-year average rate. This rate was not impacted by COVID-19 case data, as none of these recordable cases resulted in restricted workdays.

Improvement in restricted workday case rate is consistent with an improving trend in total recordable injury/illness rate (non-COVID-19). While 2020 showed a slightly higher ratio of restricted workday case rate versus total recordable case rate, 2021 is consistent with the historical correlation between the two.



\* 2021 data unavailable

Figure 3

## Days Away From Work Case Incidence Rate

Figure 4 shows the NR Program, DOE (reference 24), and BLS rates (reference 23) of occupational injury or illness cases which resulted in the individual missing one or more days of work, to include days away from work (DAFW) due to recordable COVID-19 cases. Without including recordable COVID-19 cases, the 2021 DAFW case rate of 0.19 cases per 200,000 hours worked is consistent with the 10-year historical average of 0.20 cases per 200,000 hours worked. The 24 recordable COVID-19 cases in 2021 resulted in 223 lost workdays, contributing to a rate of 0.45 cases per 200,000 hours worked. The NR Program has averaged a 20% higher DAFW case rate in comparison to DOE rates since 2017. The NR Program average DAFW case rate since 2017 is 62% lower than the days away from work case rate of BLS general industry.

Excluding COVID-19 cases, the NR Program DAFW case incidence rate continues to improve. Due to the nature of NR Program work, most sites remained at high on-site staffing levels throughout the pandemic when compared to the DOE. Although personnel protective actions taken were effective in minimizing transmission of COVID-19, COVID-19 impacts still resulted in an increased DAFW case incidence rate compared to prior years.

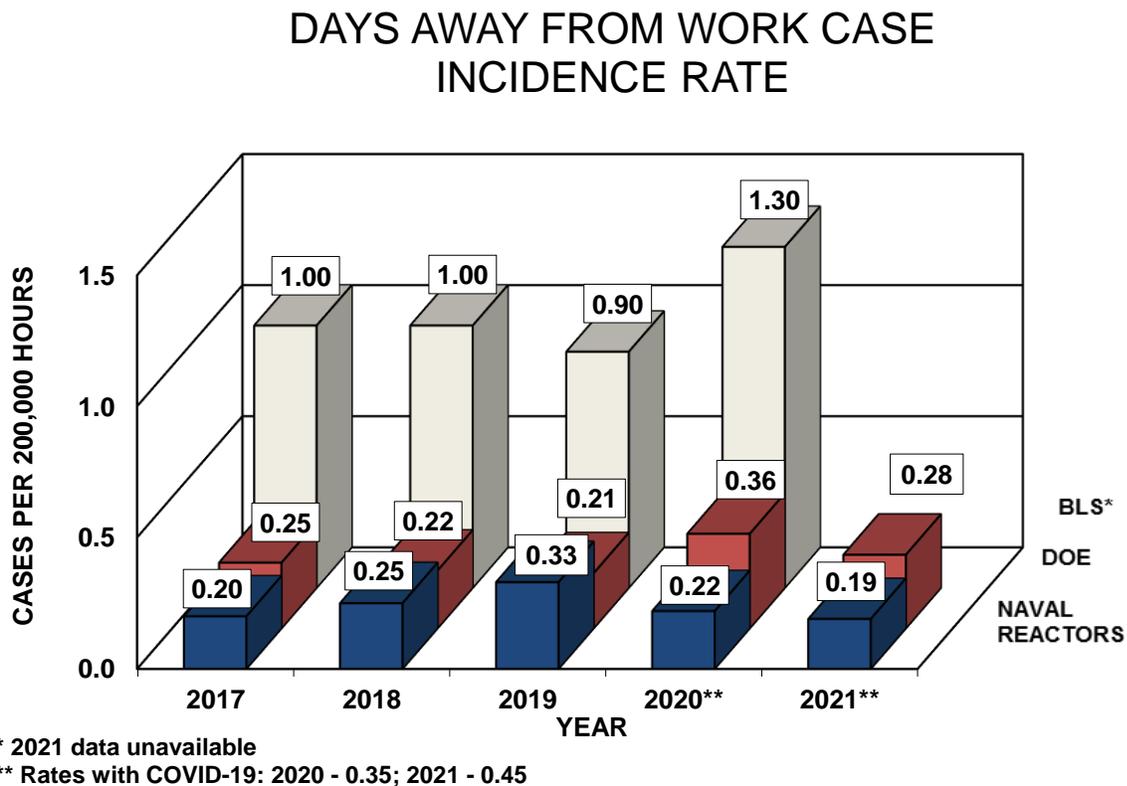


Figure 4

### Navy Injury Statistics at NNL Sites

The NR Program data in Figures 2 through 4 represent the number of cases per 200,000 hours worked by civilian personnel, as determined by the OSHA injury and illness reporting criteria (reference 22). The Navy uses different occupational injury and illness reporting parameters (reference 25); therefore, direct comparison of reported incidence rates for civilian and Navy personnel is not meaningful. However, NR reviews Navy personnel occupational injury and illness cases at NR Program facilities using the OSHA criteria for trending and tracking purposes only. In comparison, each of the incidence rates for Navy personnel at NR Program facilities was lower than the civilian workforce data for 2021 in Figures 2 through 4. Injury and illness recordable case rate for Navy personnel at NR Program facilities was 0.34 cases per 200,000 hours worked and the restricted workday case rate was 0.06 cases requiring one or more restricted workdays per 200,000 hours worked. There was one case in 2021 that required one or more days away from work with a DAFW case rate of 0.02 cases per 200,000 hours worked. These rates were not impacted by COVID-19 data as there were no recordable COVID-19 cases reported by Navy personnel.

### Naval Spent Fuel Handling (NSFH) Facility Injury Statistics

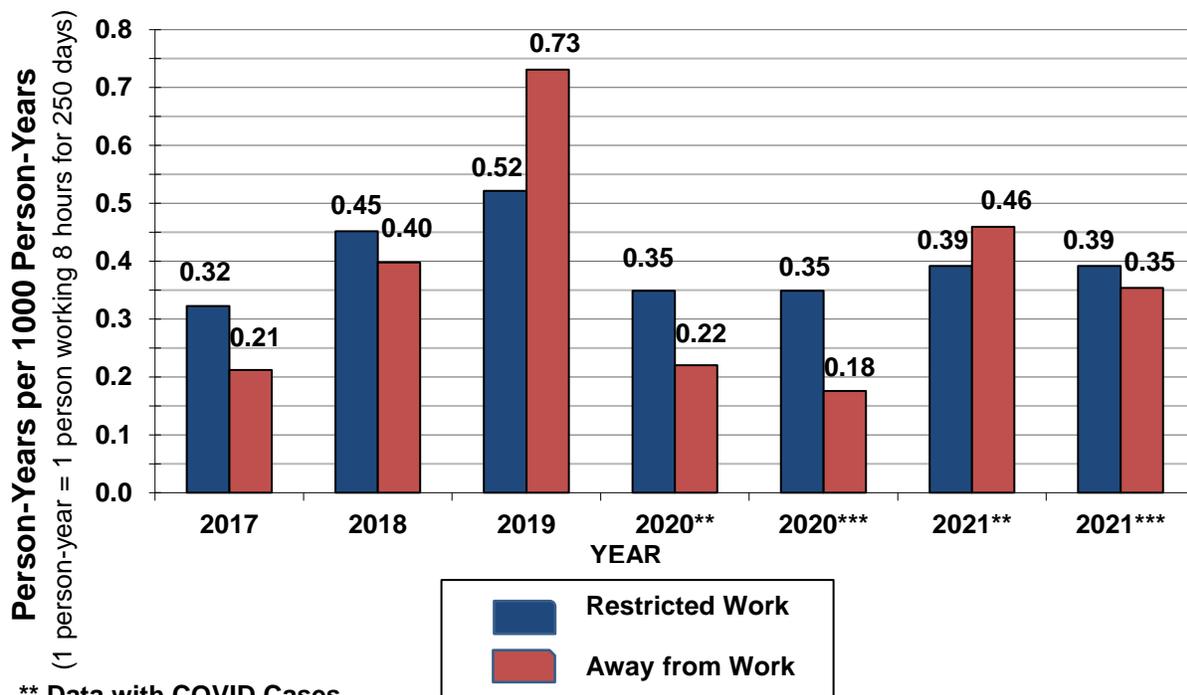
The rates discussed and graphed above do not include SFHP construction activities since construction of the NSFH Facility is following 10 CFR 851 (subparts B & C) vice the Naval Reactors Safety Requirements Manual (reference 9). During 2021, there were five recordable injuries associated with NSFH Facility construction, resulting in an injury and illness recordable case rate of 1.78 per 200,000 hours worked. There was one restricted workday case and one days away from work case in 2021.

## Cases Resulting in Work Limitations

Another view of NR Program occupational injury and illness severity is obtained by examining the person-years away or person-years restricted by a licensed health care professional as a result of more serious occupational injuries. Figure 5 depicts the number of person-years impacted by work restrictions and days away from work per one thousand person-years expended. The NR Program assesses work limitation cases and incorporates lessons learned to prevent recurrence. In 2021, 8,444 person-years of work were expended at NNL sites and NPTU-Charleston to accomplish the NR Program’s mission. Of the 8,444 person-years expended, 3.31 person-years were impacted by work restrictions and 2.99 person-years were lost to injuries at NR Program sites in 2021 (an additional 0.89 person-years were lost as a result of the recordable COVID-19 cases, increasing the associated rate from 0.35 to 0.46).

Excluding lost time due to COVID-19 injury/illness cases, several of the injuries at NR Program sites were cases in which the injuries had aggravated pre-existing conditions. These cases resulted in longer than normal time away from work, as indicated by the low recordable rate compared to the higher lost time rate.

### PERSON-YEARS LOST OR RESTRICTED BY WORK LIMITATIONS PER 1000 PERSON-YEARS (RESTRICTED WORKDAYS AND DAYS AWAY FROM WORK)



\*\* Data with COVID Cases  
 \*\*\* Data without COVID Cases

Figure 5

## ABNORMAL OCCURRENCES

It is a fact of human nature that people make mistakes. The key to a good safety program is to find the mistakes while they are small and prevent the combinations of mistakes that lead to more serious consequences.

The NR Program participates in a DOE formal, structured process to evaluate serious accidents involving civilian or military personnel at NNL facilities. The DOE has established criteria to determine the reporting and investigation requirements for accidents, including fatalities, serious injuries, and significant damage to DOE property (references 19 and 26). The Navy also has established reporting and investigation requirements for accidents (references 7, 8, and 20).

In September 2016, the NR Program conducted a DOE accident investigation in response to an event where a firefighter was injured during an offsite training exercise. The firefighter fell approximately twenty feet from a vertical ladder and sustained serious but not life-threatening injuries. The NR Program developed and implemented corrective actions based on this event. The NR Program has experienced only two events warranting a DOE accident investigation since 2004.

In addition to using the DOE accident investigation process when required, the NR Program critiques significant events that caused or could have caused injury to personnel. Critiques are formal, detailed evaluations of an event conducted by individuals in leadership roles at each facility, usually with Naval Reactors field office personnel in attendance. Pertinent facts are reviewed, underlying causes are established, and corrective actions are identified within the critique report. All corrective actions are tracked to closure to minimize the potential of more serious events with similar causes from occurring. Events that are critiqued include NR Program-defined Level 1 safety incidents and other Level 2 safety events. Level 1 safety incident category descriptions and statistics used for trending purposes are provided in the previous section of this report in Table 1 and Figure 1, respectively. Level 2 safety events have the potential for less serious consequences than Level 1 safety incidents and may include such issues as safety-related work control errors, minor injuries, and near misses.

Incident reports receive further management review, including evaluation by senior personnel at Headquarters and review by the Director of Naval Reactors. The results of these reports and the lessons learned are shared between all NR Program facilities to ensure any necessary corrections are implemented to improve worker safety.

## REFERENCES

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